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Gallbladder Needle Decompression During Radiofrequency Ablation of an Adjacent Liver Tumour

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Abstract

Gallbladder perforation with bile leak can result from thermal injury during radiofrequency ablation of liver tumours. Two case studies demonstrate a technique for preventing gallbladder injury to the peritoneal surface of a distended gallbladder adjacent to the anticipated hepatic ablation zone. The use of percutaneous gallbladder needle decompression can safely separate or retract the peritoneal surface of the gallbladder from a contiguous hepatic radiofrequency ablation zone.

Résumé

Une brûlure thermique peut causer une perforation de la vésicule biliaire avec écoulement biliaire pendant l'ablation par radiofréquence d'une tumeur hépatique. Deux études de cas révèlent une technique qui permet d'éviter d'endommager la surface péritonéale d'une vésicule biliaire distendue adjacente au site prévu d'une ablation hépatique. La décompression percutanée à l'aiguille de la vésicule biliaire permet en effet de séparer ou de rétracter en toute sécurité la surface péritonéale de la vésicule biliaire d'un site contigu d'ablation hépatique par radiofréquence.

Key Words: Radiofrequency ablation; Liver neoplasms; Gallbladder; Postoperative complications

Percutaneous, image-guided radiofrequency ablation of liver tumours adjacent to the gallbladder can be performed safely [1–5]. A serious potential complication, however, is perforation of the gallbladder and resulting bile leak [3,6]. The bare area of the hepatic gallbladder fossa constitutes the zone of gallbladder attachment to the liver [7]. The visceral peritoneum reflects from the liver surface over the unattached or peritoneal surface of the gallbladder. Thermal injury to peritoneal surfaces of the gallbladder that are unattached to the liver can result in peritoneal leakage of bile [2,3,6,7]. Thermal injury to the bare area attachment of the gallbladder, however, is unlikely to cause a bile leak but may incite a self-limited thermal cholecystitis [2].

A variety of techniques have been described for minimizing thermal injury to the gallbladder, including the use of internally cooled electrodes, artificial ascites, and ''lift-expand'' technique, as well as premedication with gallbladder motility drugs [3–5]. We present 2 cases of liver tumour radiofrequency ablation in which the anticipated ablation zone was contiguous with the peritoneal surface of the distended gallbladder. Needle decompression of the gallbladder was performed intraprocedurally, immediately before ablation, to prevent contact of the peritoneal surface of the gallbladder with the ablation zone. Retrospective review of medical records was compliant with HIPAA (Health Insurance Portability and Accountability Act) standards. The need for institutional review board approval was waived.

Case 1

A 74-year-old woman with a 2.0-cm hepatocellular carcinoma in segment 5 of the liver underwent ultrasound-guided radiofrequency ablation (Figure 1). An 18-gauge Chiba needle (Cook Medical Inc, Bloomington, IN) was inserted into the gallbladder at its bare area attachment via a transhepatic approach, and 45 mL of normal-appearing bile was aspirated. A 17-gauge Cool-Tip cluster probe (Covidien,

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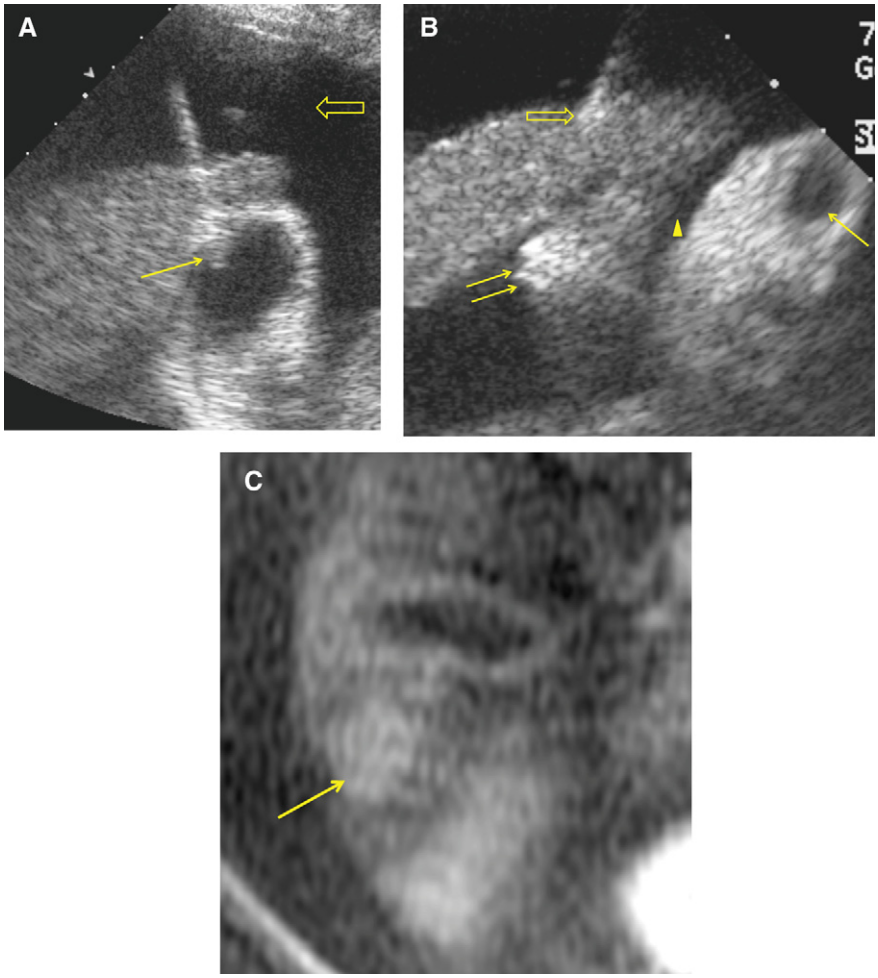

Figure 1. (A) Ultrasound image, showing percutaneous needle decompression of the previously distended gallbladder through a transhepatic approach (arrow); a large volume of ascites surrounds the gallbladder (open arrow). (B) Ultrasound image obtained more inferiorly during radiofrequency ablation, showing the decompressed gallbladder (arrow), now retracted from the liver surface with intervening ascites noted (arrowhead); the radiofrequency electrodes enter segment 5 of the liver (open arrow); echogenic foci (double arrow) demarcate the developing subcapsular hepatic ablation zone. (C) Axial contrast-enhanced T1-weighted magnetic resonance image obtained 1 day after ablation, showing expected mild hyperintensity of the ablated tumour (arrow); there was no residual tumour enhancement, and the ablation zone margin around the tumour was satisfactory; the ablation zone extends to the liver capsule adjacent to the peritonealized surface of the gallbladder, with no gallbladder injury evident.

Mansfield, MA) was then inserted percutaneously into the tumour. An additional 20 mL of bile was aspirated through the 18-gauge needle, followed by needle removal. Ultrasound images confirmed decompression of the gallbladder, which allowed movement of preexisting ascites between the peritoneal surface of the gallbladder and the liver ablation zone. A 12-minute radiofrequency ablation was performed by using impedance control mode followed by a second 12-minute overlapping ablation. No complications and no rise in serum bilirubin level occurred. A contrast-enhanced magnetic resonance imaging performed one day after the procedure revealed a 4.1-cm ablation zone that fully encompassed the 2.0-cm tumour. There was no residual tumour enhancement. There was no evidence of bile leak.

Case 2

A 65-year-old man with a 2.3-cm hepatocellular carcinoma in segment 5 of the liver underwent computed tomographic–guided radiofrequency ablation (Figure 2). A 20-gauge Chiba needle was placed percutaneously through the liver and into the gallbladder. A Cool-Tip cluster probe was then percutaneously advanced into the tumour. After aspiration of 250 mL of bile from the gallbladder, computed tomographic images confirmed retraction of the gallbladder fundus away from the expected hepatic ablation zone. The 20-gauge needle was removed, followed by a 12-minute radiofrequency application in impedance control mode. No complications occurred, and bilirubin levels remained normal. Contrast-enhanced magnetic resonance imaging, performed the following day, demonstrated complete ablation zone coverage of the tumour. There was no evidence of gallbladder-wall thickening or bile leak.

Discussion

Two patients undergoing image-guided radiofrequency ablation had hepatocellular carcinomas located near the liver

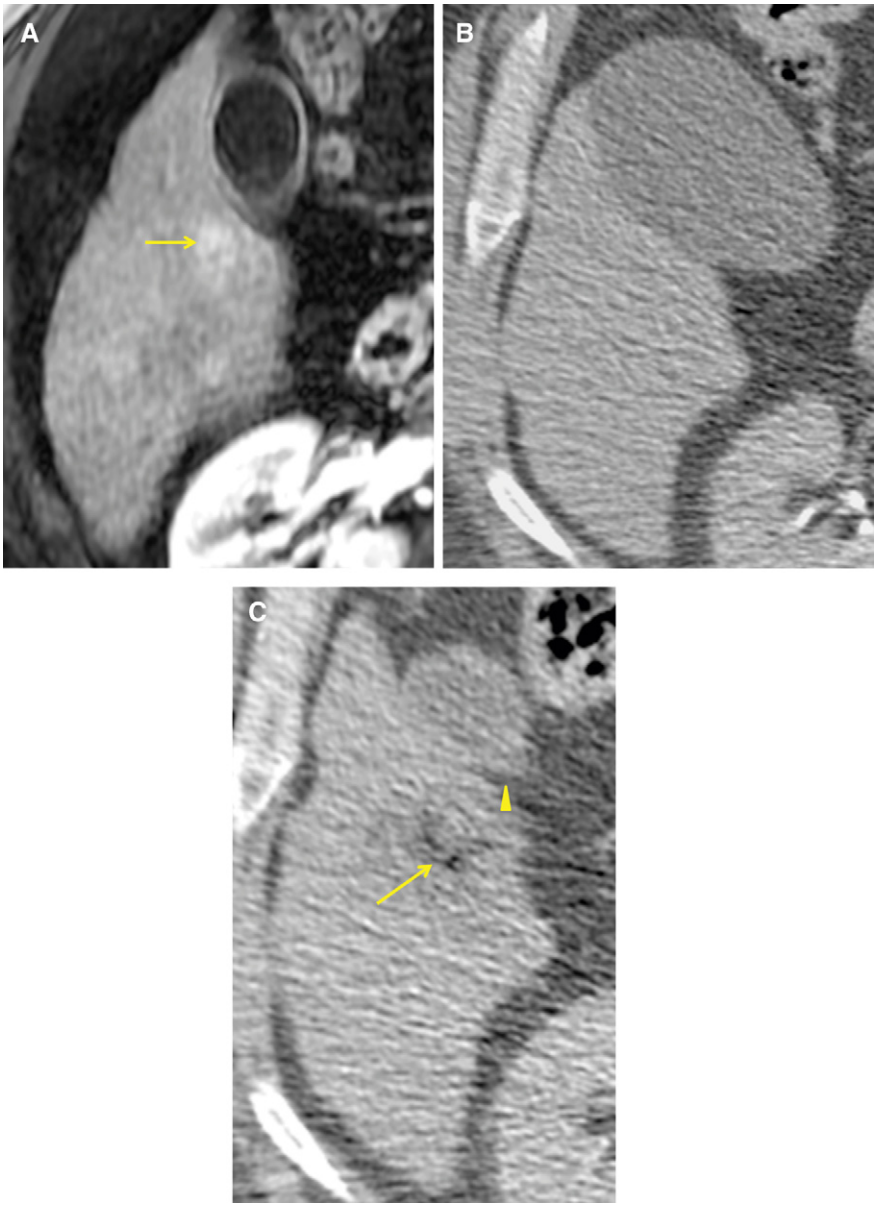

Figure 2. (A) Axial contrast-enhanced T1-weighted magnetic resonance image, demonstrating a hyperenhancing hepatocellular carcinoma in close proximity to a moderately distended gallbladder (arrow). (B) Axial unenhanced computed tomography (CT) image obtained immediately before ablation, demonstrating a distended gallbladder closely apposed to the liver capsule overlying the anticipated ablation zone. (C) Axial unenhanced CT image obtained immediately after radiofrequency ablation, showing a region of hypodensity with gas bubbles (arrow) in the hepatic ablation zone extending to the liver capsule; the decompressed gallbladder (arrowhead) is retracted from the ablation zone.

capsule, such that the anticipated ablation zone abutted the peritoneal surface of a distended gallbladder. In both cases, transhepatic needle decompression of the gallbladder allowed retraction of the peritoneal surface of the gallbladder fundus from the liver capsule and thermal ablation zone. No gallbladder injury or perforation occurred, and both tumours were successfully ablated. The needles used for gallbladder decompression were removed immediately before activation of the radiofrequency ablation generator to prevent inadvertent heating of the decompression needle located near the electrodes.

Lee [6] evaluated histopathologic changes in the gallbladder wall adjacent to radiofrequency ablation zones by using a pig model. Histologic changes were observed in all cases after ablation. As long as direct injury to the gallbladder is limited to the hepatic bare area attachment, however, the resulting thermal cholecystitis is likely to be self-limited and not complicated by bile leakage [2]. In an effort to prevent gallbladder complications, lesions adjacent to the gallbladder are sometimes incompletely ablated [4,5]. In addition, bile within the gallbladder creates a limited heat sink effect, which may provide some protection of the gallbladder wall but may also slow the heating of tumour tissue adjacent to the gallbladder [3,6]. The need to overcome this heat sink may require placement of electrodes closer to the gallbladder or may require longer ablation times. Close

placement of the electrodes and longer ablation times could increase the risk of injury to free peritoneal surfaces of the gallbladder that abut the hepatic ablation zone. Because the majority of patients undergoing radiofrequency ablation are instructed to fast for 6 hours or more before the procedure, gallbladder distention may cause peritoneal surfaces of the gallbladder to be closely applied to the adjacent liver capsule.

Percutaneous needle aspiration of the gallbladder for diagnostic purposes has previously been shown to be a safe procedure. In a study of 207 patients undergoing needle aspiration of the gallbladder, no major complications, such as bile leak, bleeding, or inflammation, were observed [8]. The technique involves insertion of an 18-gauge or smaller needle, by using a transhepatic approach, and entering through the hepatic bare area attachment of the gallbladder. This approach allows for gallbladder decompression without spillage of bile into the peritoneal cavity. The gallbladder needle decompression technique, when compared with the use of gallbladder motility medications, has the advantage of producing immediate and complete emptying of the gallbladder, without potential drug adverse effects.

In conclusion, percutaneous needle decompression of the gallbladder can be performed immediately before liver tumour radiofrequency ablation to retract the peritoneal surface of a distended gallbladder from an adjacent hepatic ablation zone. This technique may help prevent thermal injury to the peritoneal surface of the gallbladder wall and associated peritoneal bile leakage.

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